I CLAIM:

1. A method of maintaining a desired phase relationship between a generated periodic signal and a periodic reference signal, said method comprising:

generating a periodic signal with a delay line comprising a plurality of unit delays connected in series, the number of said unit delays involved in said generating being selectable and ranging from all to one of said plurality of unit delays;

measuring a phase difference between said periodic reference signal and said generated periodic signal after a predetermined number of cycles of said generated periodic signal;

selecting via digital signals a number of said plurality of unit delays in said delay line based on said phase difference and said desired phase relationship; and

generating said periodic signal with said delay line having only said selected number of unit delays involved in said generating.

2. The method of claim 1 further comprising maintaining said selected number of unit delays while the magnitude of said measured phase difference is less than a certain value.

3. The method of claim 1 further comprising maintaining said selected number of unit delays while the magnitude of said measured phase difference is less than the delay time of one of said unit delays.

4. The method of claim 1 wherein said desired phase difference is zero degrees.

5. The method of claim 1 wherein said digital signals include only one HIGH logic level signal, all others being LOW logic level signals.

6. The method of claim 1 wherein said selecting comprises selecting a higher number of said unit delays via digital signals when said phase difference is positive.

7. The method of claim 1 wherein said selecting comprises selecting a lower number of said unit delays via digital signals when said phase difference is negative.

8. The method of claim 1 wherein said selecting comprises selecting a number of unit delays via digital signals that differs from the last selected number by one unit delay.

9. A method of maintaining a desired phase relationship between a generated periodic signal and a periodic reference signal, said method comprising:

generating a first periodic signal with a first delay line and a second periodic signal with a second delay line, each delay line comprising a plurality of unit delays connected in series, the number of unit delays involved in said generating being selectable by digital signals, the difference between said selected number of unit delays in said first delay line and in said second delay line being at least one unit delay;

phase mixing said first and said second generated periodic signals according to an adjustable phase mixing ratio to produce a phase-mixed signal;

measuring a phase difference between said periodic reference signal and said phase mixed signal after a plurality of cycles of said phase mixed signal;

adjusting if necessary at least one of said phase mixing ratio and said number of unit delays in at least one of said first and said second delay lines based on said phase difference and said desired phase relationship; and

generating said first and second periodic signals after said adjusting.

10. The method of claim 9 wherein said adjusting further comprises maintaining said selected number of unit delays in each of said first and said second delay lines while the magnitude of said measured phase difference is less than a certain value.

11. The method of claim 9 wherein said adjusting further comprises maintaining said phase mixing ratio when said selected number of unit delays in each of said first and said second delay lines are adjusted.

12. The method of claim 9 wherein said adjusting further comprises resetting said phase mixing ratio when said selected number of unit delays in each of said first and said second delay lines are adjusted.

13. The method of claim 9 wherein said adjusting further comprises maintaining said selected number of unit delays in each of said first and said second delay lines when said phase mixing ratio is adjusted.

14. The method of claim 9 the wherein said adjusting further comprises adjusting said selected number of unit delays in each of said first and said second delay line by the same number of said unit delays.

15. The method of claim 9 wherein said adjusting further comprises maintaining said phase mixing ratio while the magnitude of said measured phase difference is greater than a certain value.

16. The method of claim 15 wherein said certain value is equal to the delay time of one of said unit delays.

17. The method of claim 9 wherein said adjusting further comprises maintaining said phase mixing ratio while the magnitude of said measured phase difference is less than a certain value.

18. The method of claim 9 wherein said adjusting further comprises adjusting said selected number of unit delays in at least one of said first and said second delay lines when said phase mixing ratio cannot be further adjusted.

19. The method of claim 9 further comprising:

phase mixing said first and said second generated periodic signals according to a second adjustable phase mixing ratio to produce a second phase-mixed signal; and

phase mixing said phase-mixed signal with said second phase mixed signal to produce a third

phase mixed signal; wherein said measuring comprises:

measuring a phase difference between said periodic reference signal and said third phase mixed signal after a plurality of cycles of said third phase mixed signal.

20. The method of claim 19 wherein said phase-mixing ratio and said second phase mixing ratio are equal.

21. A method of maintaining a desired phase relationship between a generated periodic signal and a periodic reference signal, said method comprising:

receiving said periodic reference signal;

generating a first periodic signal and a second periodic signal, each having a phase, in response to said receiving;

phase mixing said first and said second generated periodic signals according to an adjustable phase mixing ratio to produce a phase-mixed signal;

measuring said phase difference between said received periodic reference signal and said phase mixed signal after a plurality of cycles of said phase mixed signal;

adjusting if necessary via digital signals said phase mixing ratio in response to said measuring; and

generating said first and second periodic signals after said adjusting.

22. A method of maintaining a desired phase relationship between a generated periodic signal and a periodic reference signal, said method comprising:

phase mixing a first and a second periodic signal according to a first adjustable phase mixing ratio to produce a first phase-mixed signal;

phase mixing said first and said second periodic signals according to a second adjustable phase mixing ratio to produce a second phase-mixed signal;

phase mixing said first and said second phase mixed signals according to a third adjustable phase mixing ratio to produce a third phase-mixed signal;

measuring a phase difference between said periodic reference signal and said third phase mixed signal after a plurality of cycles of said third phase mixed signal; and

adjusting, if necessary, via digital signals at least one of said first phase mixing ratio, said second phase mixing ratio, and said third phase mixing ratio in response to said measuring to maintain said desired phase relationship between said periodic reference signal and said third phase mixed signal.

23. A digital delay-locked loop circuit comprising:

a multiplexer;

a delay line having an input, an output, and a plurality of serially-connected unit delay elements, each said unit delay element selectable to directly receive a delay line input signal, the output of said delay line being fed-back via said multiplexer to said delay line input to form a loop, said delay line loop operative to generate a periodic signal from at least the last one of said plurality of delay elements;

a phase detector having a first input operative to receive a periodic reference signal, a second input operative to receive said generated periodic signal, and an output, said detector operative to detect a phase difference between said periodic reference signal and said generated periodic signal;

delay control logic having an output and an input, said input operative to receive said phase detector output, said delay control logic operative to select one of said unit delay elements; and

logic operative to activate said phase detector and said delay control logic and to enable said multiplexer after a plurality of cycles of said generated periodic signal.

24. A digital delay-locked loop circuit comprising:

a multiplexer;

a first delay line having an input, an output, and a plurality of serially-connected unit delay elements, each said unit delay element selectable to directly receive the delay line input, the output of said delay line being fed-back via a multiplexer to said delay line input to form a loop, said delay line loop operative to generate a periodic signal from at least the last serially-connected delay line element;

a second delay line having an input, an output, and a plurality of serially-connected unit delay elements, each said unit delay element selectable to directly receive the delay line input, the output of said delay line being fed-back via a multiplexer to said delay line input to form a loop, said delay line

loop operative to generate a periodic signal from at least the last serially-connected delay element;

a phase mixer having a first input operative to receive said generated periodic reference signal of said first variable delay line, a second input operative to receive said generated periodic reference signal of said second variable delay line, a phase-mixing ratio control input, and an output, said phase mixer operative to mix said generated periodic signals of said first and said second delay lines according to a digital phase mixing ratio control signal to generate a phase-mixed signal;

a phase detector having a first input operative to receive a periodic reference signal, a second input operative to receive said generated phase-mixed signal, and an output, said detector operative to detect a phase difference between said periodic reference signal and said generated phase-mixed signal; and

control logic having an input operative to receive said output of said phase detector, said control logic operative to issue digital signals selecting one of said unit delay elements of said first delay line and one of said unit delay elements of said second delay line and to issue a digital phase-mixing ratio control signal.

25. Apparatus for maintaining a desired phase relationship between a generated periodic signal and a periodic reference signal, said apparatus comprising:

means for generating a periodic signal with a delay line comprising a plurality of unit delays

connected in series, the number of said unit delays involved in said generating being selectable and ranging from all to one of said plurality of unit delays;

means for measuring a phase difference between said periodic reference signal and said generated periodic signal after a predetermined number of cycles of said generated periodic signal;

means for selecting a number of said plurality of unit delays in said delay line based on said phase difference and said desired phase relationship; and

means for generating said periodic signal with said selected number of unit delays.

26. The apparatus of claim 25 further comprising means for maintaining said selected number of unit delays while the magnitude of said measured phase difference is less than a certain value.

27. Apparatus for maintaining a desired phase relationship between a generated periodic signal and a periodic reference signal, said apparatus comprising:

means for generating a first periodic signal with a first delay line and a second periodic signal with second delay line, each delay line comprising a plurality of unit delays connected in series, the number of unit delays involved in said generating being selectable via digital signals, the difference between said selected number of unit delays in said first delay line and said second delay line being at least one unit delay;

means for phase mixing said first and said second generated periodic signals according to an adjustable phase mixing ratio to produce a phase-mixed signal;

means for measuring a phase difference between said periodic reference signal and said phase mixed signal after a plurality of cycles of said phase mixed signal;

means for adjusting if necessary at least one of said phase mixing ratio and said number of unit delays in at least one of said first and said second delay lines based on said phase difference and said desired phase relationship; and

means for generating said first and second periodic signals after said adjusting.

28. The apparatus of claim 27 wherein said means for adjusting further comprises means for maintaining said selected number of unit delays in each of said first and said second delay lines while the magnitude of said measured phase difference is less than a certain value.

29. The apparatus of claim 27 the wherein said means for adjusting further comprises means for adjusting said selected number of unit delays in each of said first and said second delay line by the same number of said unit delays.

30. The apparatus of claim 27 wherein said means for adjusting further comprises means for maintaining said phase mixing ratio while the magnitude of said measured phase difference is greater than a certain value.

31. The apparatus of claim 27 wherein said means for adjusting further comprises means for maintaining said phase mixing ratio while the magnitude of said measured phase difference is less than a certain value.

32. The apparatus of claim 27 wherein said means for adjusting further comprises means for adjusting said selected number of unit delays in at least one of said first and said second delay lines when said phase mixing ratio cannot be further adjusted.

33. The apparatus of claim 27 further comprising:

means for phase mixing said first and said second generated periodic signals according to a second adjustable phase mixing ratio to produce a second phase-mixed signal; and

means for phase mixing said phase-mixed signal with said second phase mixed signal to produce a third phase mixed signal; wherein said means for measuring comprises:

means for measuring a phase difference between said periodic reference signal and said third phase mixed signal after a plurality of cycles of said third phase mixed signal.

34. The apparatus of claim 33 wherein said phase-mixing ratio and said second phase mixing ratio are equal.

35. Apparatus for maintaining a desired phase relationship between a generated periodic signal

and a periodic reference signal, said apparatus comprising:

means for phase mixing a first and a second periodic signal according to a first adjustable phase mixing ratio to produce a first phase-mixed signal;

means for phase mixing said first and said second periodic signals according to a second adjustable phase mixing ratio to produce a second phase-mixed signal;

means for phase mixing said first and said second phase mixed signals according to a third adjustable phase mixing ratio to produce a third phase-mixed signal;

means for measuring said phase difference between said periodic reference signal and said third phase mixed signal after a plurality of cycles of said third phase mixed signal; and

means for adjusting at least one of said first phase mixing ratio, said second phase mixing ratio, and said third phase mixing ratio in response to said measuring to maintain said desired phase relationship between said periodic reference signal and said third phase mixed signal.

36. A computer system comprising:

a processor;

a memory controller coupled to said processor; and

a plurality of dynamic random access memory (DRAM) chips coupled to said memory controller, at least one of said DRAM chips comprising a delay-locked loop circuit comprising:

a multiplexer;

a delay line having an input, an output, and a plurality of serially-connected unit delay elements, each said unit delay element selectable to directly receive a delay line input signal, the output of said delay line being fed-back via said multiplexer to said delay line input to form a loop, said delay line loop operative to generate a periodic signal from at least the last one of said plurality of delay elements;

a phase detector having a first input operative to receive a periodic reference signal, a second input operative to receive said generated periodic signal, and an output, said detector operative to detect a phase difference between said periodic reference signal and said generated periodic signal;

delay control logic having an output and an input, said input operative to receive said phase detector output, said delay control logic operative to select one of said unit delay elements; and

logic operative to activate said phase detector and said delay control logic and to enable said multiplexer after a plurality of cycles of said generated periodic signal.